IN THE UNITED STATES PATENT AND TRADEMARK OFFICE
BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES

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APPLICANT	:	Eduard Kugler
SERIAL NO.	:	09/362,397
FILING DATE	:	July 28, 1999
EXAMINER	:	R. McDonald
GROUP ART UNIT	:	1753
FOR	:	INFORMATION CARRIER, METHOD FOR PRODUCING SAME

MAIL STOP APPEAL BRIEF - PATENTS
Commissioner of Patents
P.O. Box 1450
Alexandria, Virginia 22313-1450

TRANSMITTAL OF APPEAL BRIEF
(PATENT APPLICATION - 37 C.F.R. 1.192)

Sir:

Transmitted herewith, in triplicate, is the APPEAL BRIEF in this application, with respect to the Notice of Appeal filed on **September 15, 2003.**

1. STATUS OF APPLICANT

This application is on behalf of **Unaxis Balzers AG**, which is not a small entity and which is the real party in interest.

2. FEE FOR FILING APPEAL BRIEF

Pursuant to 37 C.F.R. 1.17(f), the fee for filing the Appeal Brief is $330.00.

3. EXTENSION OF TIME

The proceedings herein are for a patent application and the provisions of 37 C.F.R. 1.136 apply. Applicant petitions for an extension of time under 37 CFR 1.136 for one/two/three month(s); that is, to and including _____.

Pursuant to 37 CFR 1.17(a/b/c) the fee is $110.00/420.00/950.00 (Reduced by 50% if applicant is a SMALL ENTITY).

If an additional extension of time is required, please consider this a petition therefor.

4. TOTAL FEES DUE

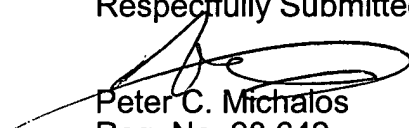|		
Appeal Brief	:	$ 330.00
Extension of Time (if applicable)	:	
Total Fee Due	:	**$ 330.00**

5. FEE PAYMENT

Attached is a check in the amount of $ 330.00

The Commissioner is further authorized to charge or credit our Deposit Account No. 14-1431 with any under or over payments of fees relating to this application.

Entry of this Brief on Appeal is respectfully requested.

Respectfully Submitted,

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Attorney for Applicants

Dated: 11/07/08

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BRIEF ON APPEAL (37 C.F.R. 1.192)

This brief is in furtherance of the Notice of Appeal, filed in this case on September 10, 2003. The fee of $330.00 required under 37 CFR 1.17(c) accompanies this brief and is referred to in the accompanying TRANSMITTAL OF APPEAL BRIEF.

This brief is transmitted in triplicate (37 C.F.R. 1.192(a)).

This brief contains the following sections under the following headings, and in the order set forth below (37 CFR 1.192(c)):

The final page of this brief bears the signature of the Attorney of Record.

I   REAL PARTY IN INTEREST (37 C.F.R. 1.192(C)(1))

The real party in interest in this appeal is Unaxis Balzers Aktiengesellschaft, the assignee of the present application.

II   RELATED APPEALS AND INTERFERENCES (37 C.F.R. 1.192(c)(2))

There are no related appeals or interferences which would have any bearing on the Board's decision in this appeal.

III   STATUS OF CLAIMS (37 C.F.R. 1.192(c)(3))

Claims 91 to 149 have been finally rejected and are all on appeal.

Claims 1 to 90 have been canceled.

No claim has been allowed.

IV   STATUS OF AMENDMENTS (37 C.F.R. 1.192(c)(4))

No amendment after the final rejection has been filed.

The claims on appeal are set forth in this brief at Section IX APPENDIX OF CLAIMS.

V   SUMMARY OF INVENTION (37 C.F.R. 1.192(c)(5))

The invention is a method for manufacturing an information carrier such as a CD or compact disk (specification page 2, lines 2-5 and 27-31) of the type which has two or more information carrying interfaces so that the data capacity is at least doubled over single interface carriers (specification, page 2, lines 5-7).

The method particularly concentrates on the making of an intermediate layer (reference numeral 3 in Fig. 1) between the two information carrying interfaces (specification, page 1, lines 10-13).

A.   The Independent Claims:

Independent claims 91, 92 and 107 (all the independent claims on appeal) each define a method for producing an information carrier shown in its simplest form in Fig. 1 below (specification, page 9, lines 9-11), comprising at least two solid material interfaces (3o and 3u in Fig. 1; specification, page 9, line 29 to page 10, line 2) adapted to contain information and whereat the information is stored by local modulation (7 on Fig. 1) of at least one solid material characteristic, from which characteristic reflection of electromagnetic radiation (9, 9_{out1} and 9_{out2} in Fig. 1; specification page 11, lines 5-6) depends at each interface (specification, page 10, lines 7-13).

The information carrier further comprising at least one intermediate layer (3 in Fig. 1) between the two solid material interfaces (3o, 3u). At least one of the
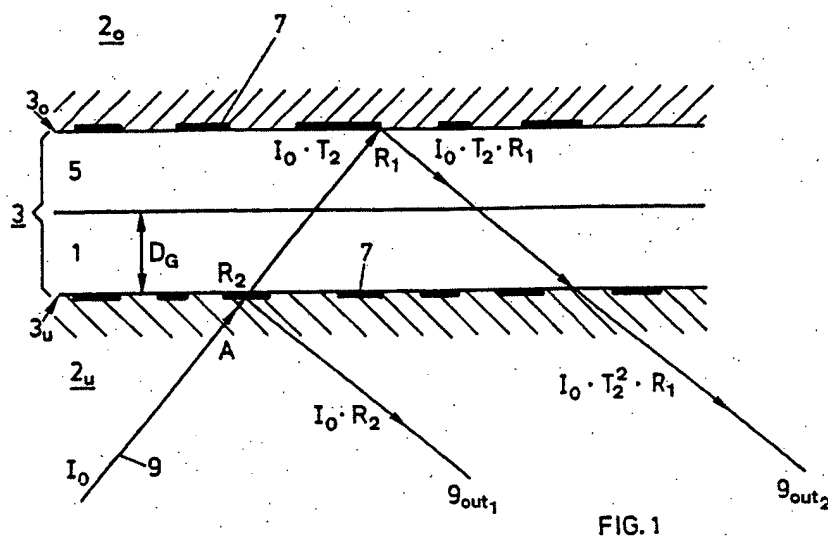
FIG. 1

intermediate layers transmits the radiation (see the path of light 9 and 9_{out2} in layer 3 of Fig. 1) and the information is readable from at least one of the solid material interfaces by means of radiation of predetermined wavelength (specification page 18, lines 8-27).

The forgoing requirements is the same for all claims.

The method of independent Claim 91 further comprises the step of depositing in the intermediate layer (3), at least one layer (1) that is at least predominantly Si_vN_w (specification page 9, line 20) by means of a reactive vacuum coating process

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(specification page 21, lines 24-30; page 22 lines 8-15; page 24, line 25 to page 25, line 2; and vacuum chamber 51 in Fig. 4 and vacuum recipient 71 in Fig. 5 reproduced below). The method further comprises the step of freeing Si (silicon) from a solid body (specification page 22, lines 8-13 and page 24 lines 25-29; and Si target 55 in Fig. 4 and on magnetron source 70 in Fig. 5) into a process atmosphere with a reactive gas containing N (specification page 24, lines 6-9).

FIG. 4

FIG.5
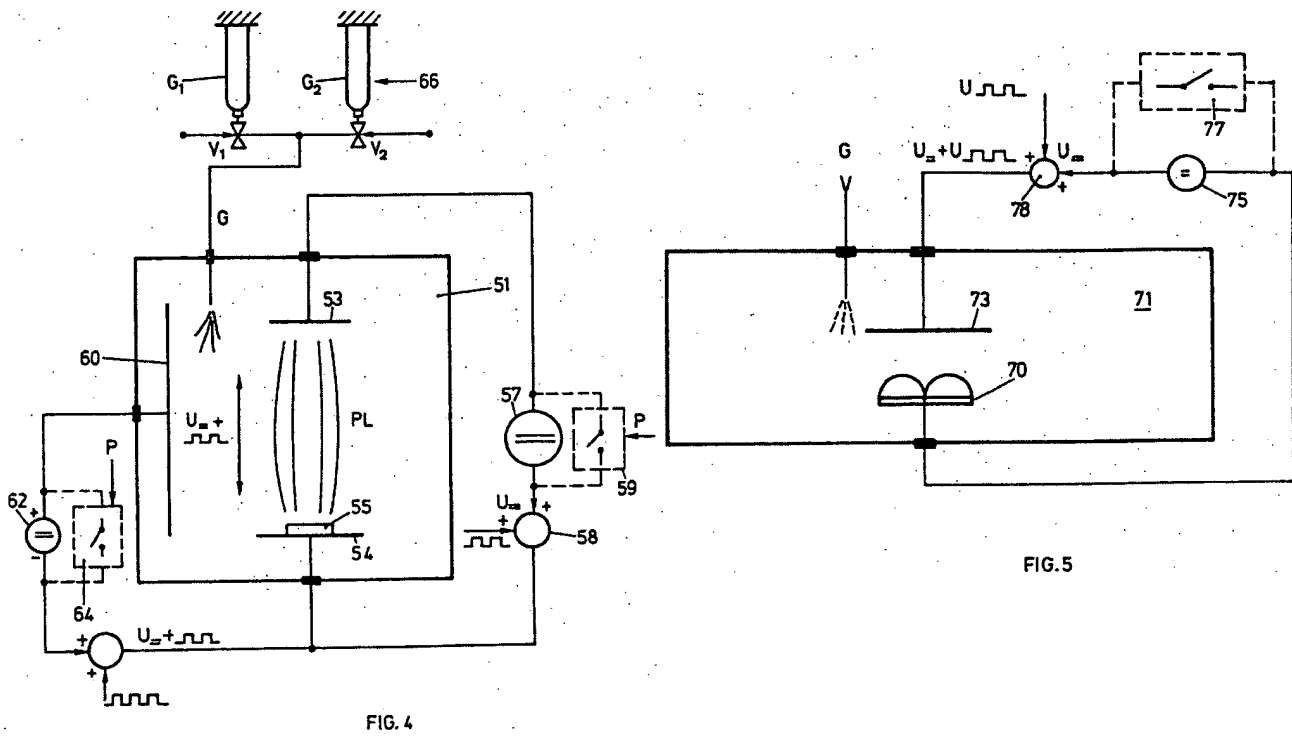
Independent Claim 92 calls for the method to further comprise depositing in the intermediate layer (3), at least one layer (1) that is predominantly $Si_vN_wH_u$ (specification page 9, line 18) by means of a reactive vacuum coating process (Figs. 4 or 5) in a process atmosphere; an optimum of transmission of the layer and of a refractive index of the material of the layer being achieved (specification page 21, line 4-13) by adjusting the concentration of a reactive gas in the process atmosphere, which reactive gas comprises N and H.

Independent Claim 107 calls for the method to further comprise depositing the intermediate layer (3) in such a way that it has a layer system with at least one dielectric layer (1) with an optical thickness which, at least in a first approximation, is $m \cdot \lambda_0/4$, where m is an uneven integer of at least unity and where λ_0 designates the wavelength of the radiation which is transmitted through the at least one dielectric layer and wherein, starting from the premiss that m is an integer, m can be reduced by as much as 0.6 of its integer value, or increased by as much as 0.2 of its integer value (specification page 6, lines 9-20), thereby loosening manufacturing tolerance while still making a functional product (specification page 6, line 20).

Before summarizing the invention further in connection with the remaining dependent claims, it is noted that advantages of the invention include (specification, page 35):

- low cost manufacturing due to the fact that very thin layers may be used which drastically reduce manufacturing time by exploiting the claimed stoichiometries;

- matching of multiple reflected beams;

- adjust signal levels to player capabilities (where music CDs are made by the invention);

- adjust the signal levels reached to the thickness distribution performance realizable with a specific coating chamber;

- improved adherence on chamber walls and masks for metallic layers to reduce flaking-off problems;

- simpler process control in that it is possible to work near the metallic deposition mode (the closer one can work in a reactive process to the metallic mode, the smaller is the danger to abruptly and uncontrollably jump into reactive mode);

- the use of nitrogen instead of propane or methane additionally reduces security

measures; and

- realization of 25% signals from two information carrying interfaces even with a blue laser at 450 nm.

B.   <u>Claims Dependant From Claims 91 or 92:</u>

According to Claim 93, the method of Claim 92 further requires the silicon (Si) to be freed into the process atmosphere from a solid body (specification page 8, lines 1-4; page 24, lines 25-29; page 25, lines 7-11; and Fig. 4 at Si target 55). This was a feature of independent Claim 91 but not of independent Claim 92.

According to Claim 94, the method of Claim 92 further requires the gas in the process atmosphere to be at least predominantly two different gases with different ratios, in particular carbon (C) content to hydrogen (H) content or nitrogen (N) content to hydrogen content, and wherein the optimum is either open-loop- or negative-feedback-controlled (specification page 21, lines 4-11) by adjusting the ratio of the amounts of the two gases in the process atmosphere (page 24, lines 6-22; and Fig. 4, valves V1 and V2 for gases G1 and G2).

Claim 95 calls to the method of either Claim 91 or Claim 92 to further comprise applying a DC-voltage between a carrier for the workpiece where the layer is produced (carrier 60 in Fig. 4 or 73 in Fig. 5) and an electrode in a vacuum atmosphere (electrode 54 in Fig. 4 or 70 in Fig. 5), and superimposing an AC-voltage on the DC-voltage (specification page 22, line 25 to page 23, line 9; and Fig. 4, DC source 57 and AC unit 58).

Claim 96 defines the method of Claim 95 where the superimposed AC-voltage is a pulsating voltage (specification page 32, lines 9-15; and Fig. 4 at chopper 59).

The invention of Claim 97 is the method of claim 95 where the AC-voltage is generated by intermittently connecting the carrier (60 in Fig. 4) to the electrode (54 in Fig. 4) via first and second current paths, and where the second current path has a

considerably lower resistance than the first current path (specification page 23, lines 9-31; and Fig. 4 at chopper unit 64).

Claim 98 defines a method according to Claims 91 or 92 which comprises either reactive sputtering (Fig. 5) or ion plating (Fig. 4) as the reactive vacuum coating process (specification page 25, lines 7-13).

Claim 99 defines a method according to Claim 98 where the sputtering is performed by magnetron sputtering (Fig. 5; specification page 24, line 25 to page 25, line 6).

Claim 100 defines the method of Claims 91 or 92 where a target of negative or positive doped silicon (specification page 25, lines 7-11) and is reactively sputtered, or ion plated, or reactive magnetron sputtered.

Claim 101 calls for a method according to Claims 91 or 92, wherein the reactive gas is hydronitrogen and is fed to the process atmosphere (specification page 24, lines 6-9; and Fig. 4, gas G to chamber 51).

Claim 102 is the method of Claims 91 or 92 where the reactive gas is Ammonia (specification page 24, line 14 and page 32, line 6).

Claim 103 is the method of Claims 91 or 92 where the reactive gas includes Nitrogen (specification page 32, line 6).

Claim 104 is the method of Claims 91 or 92 where the layer (1 in Fig. 1) is produced as a layer of an intermediate layer (3 in Fig. 1) between two solid material interfaces (3o and 3u in Fig. 1) of an information carrier, at which interfaces information (7, 7 in Fig. 1) is adapted to be applied and whereat the information is stored by local modulation of at least one solid material characteristic, from which characteristic reflection of electromagnetic radiation (9, 9in, 9out in Fig. 1) depends at the interfaces.

Claim 105 is the method according to Claims 91 or 92 where the layer (1) is produced at an information carrier as an intermediate layer (3) between two solid material interfaces (3o, 3u), which intermediate layer comprises a dielectric layer system

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(specification page 9, line 17) with at least one layer, at which interfaces information is adapted to be applied and whereat the information is stored by local modulation of at least one solid material characteristic, from which characteristic reflection of electromagnetic radiation depends at said interfaces (all as in Claim 104). Claim 105 further calls for the layer system (1) to have an optical thickness which, at least in a first approximation, is m · $\lambda_o/4$, wherein m is integer and at least unity and is uneven and wherein λ_o designated the wavelength of the radiation (9) which is transmitted through the at least one dielectric layer (1) of the dielectric layer system (specification page 14, line 15 to page 15, line 4).

Claim 106 is a method according to Claims 91 or 92 which includes applying a silver layer (specification page 19, lines 15-18; layer 2o' in Fig. 2) between one of the solid material interfaces and the intermediate layer.

C.   Claims Dependant From Claim 107:

Claim 108 defines a method according to Claim 107 which includes depositing the intermediate layer so that the electromagnetic radiation for either applying or reading information has a wavelength within the band of 400nm $\leq \lambda_s \leq$ 800nm (specification page 14, line 12).

Claim 109 defines a method according to Claim 107 where at least one of the solid material interfaces is made to have a reflection of from about 20% to about 40% for a selected wavelength of the radiation (specification page 17, lines 25-28).

Claim 110 calls for the method of Claim 107 where the intermediate layer (3) is deposited to have an index of refraction of greater than or equal to 2.59 and less than or equal to 4.6 and an extinction coefficient of less than or equal to 3.0 (specification page 34, lines 17-19).

Claim 111 calls for the method of Claim 107 where the dielectric layer (1) at least predominantly consists of silicon carbide Si_xC_y or silicon nitride Si_vN_w (specification page

5, lines 16-26).

Claim 112 defines a method according to Claim 107 where the locally modulated characteristic is the thickness of a solid material body defining at least one of the solid material interfaces (specification page 10, lines 7-13; and Fig. 2 at 3o' and 3u').

Claim 113 is a method according to Claim 107 where the reflection is valid for a first wavelength at the first material interface and for a second wavelength at the second material interface, reflection of radiation of the second wavelength at the first interface being significantly lower than of radiation of the first wavelength (specification page 18, lines 17-23).

Claim 114 is the method of 113 where the first wavelength is approximately 635 nm or approximately 650 nm (specification page 2, line 13).

Claim 115 is the method of Claim 113 where the intermediate layer comprises at least one dielectric layer having an optical thickness which is an at least approximately uneven multiple of a quarter of the first or second wavelength and is at least approximately an even multiple of a quarter of the other wavelength (specification page 18, lines 23-27).

Claim 116 is the method of Claim 113 where the second wavelength is approximately 785 nm (specification page 18, lines 17-23).

Claim 117 is the method of Claim 113 where reflection of the radiation at the second wavelength and at the first solid material interface is 10% at most (specification page 16, lines 20-25).

Claim 118 is the method of Claim 107 wherein either: (a) the index of refraction n_1 of the intermediate layer (3) is: $2.59 \le n_1 \le 4.6$ (specification page 34, lines 17-19); or (b) the extinction coefficient k of the intermediate layer is $k_{300\,nm} \le 3.0$ (specification page 34, lines 20-22).

Claim 119 is the method of Claim 107 where the intermediate layer comprises a spacer layer (5 in Fig. 1; specification page 9, lines 12-13).

Claim 120 is the method of Claim 119 where the spacer layer consists of lacquer and/or glue (specification page 9, lines 12-16; and page 39, original Claim 16).

Claim 121 is the method of Claim 107 where the dielectric layer (1) consists at least predominantly of ZrN or HfN or TiN (specification page 6, lines 21-23).

Claim 122 is the method of Claim 121 where the dielectric layer at least predominantly consists of ZrN (specification page 6, lines 21-23).

Claim 123 is the method of Claim 107 where one of the solid material interfaces (3o, or 3u) is formed between the intermediate layer (1) and a plastic material (2u in Fig. 1; and specification page 16, lines 20-25) or between the intermediate layer (1) and a spacer layer (5 in Fig. 1) or between the intermediate layer (1) and a high reflecting cover layer (2oᴅ in Fig. 2; and specification page 19, lines 15-18).

Claim 124 called for the method of Claim 123 where at least one of the following is valid: the plastic material (2oᴅ) is either polycarbonate or PMMA (specification page 19, lines 12-14); and/or the spacer layer (5) is at least predominantly lacquer and/or glue (specification page 9, lines 12-16; and page 39, original Claim 16); and/or the high reflecting cover layer is at least predominantly of Al, Au and/or Ag (specification page 19, lines 15-18).

Claim 125 is the method of Claim 124 where the high reflecting cover layer consisting at least predominantly of Al (specification page 19, line 16).

Claim 126 defines the method of 107 where one of the solid material interfaces (3o in Fig. 1) is formed at a lacquer surface (5 in Fig. 1).

Claim 127 is the method of Claim 126 where the lacquer is hardenable by means of ultra-violet radiation (specification page 19, line 25).

Claim 128 is the method of Claim 107 where the intermediate layer comprises at least one semiconductor doping material (specification page 28, line 12; page 40, original Claim 24).

Claim 129 is the method of Claim 128 where the doping material is Boron and/or Phosphor (specification page 25, lines 7-11).

Claim 130 is the method of Claim 107 where the intermediate layer comprises C (carbon) and forms at least one of the solid material interfaces with a further material which contains C as well (specification page 16, line 26 to page 17, line 1).

Claim 131 is the method of Claim 107 where radiation in the blue spectral range of $400 \leq \lambda_s \leq 500$ nm performs reading and/or writing of the information (specification page 18, line 8-11).

Claim 132 is the method of Claim 107 where the intermediate layer comprises at least one of Si_xC_y and of $Si_xC_yH_z$, wherein $x \geq y$ (specification page 11, line 21).

Claim 133 is the method of Claim 107 where the intermediate layer comprises at least one of Si_vN_w and $Si_vN_wH_u$, wherein $v \geq w$ (specification page 11, line 21).

Claim 134 is the method of Claim 107 where the intermediate layer comprises at least one of Si_xC_y and $Si_xC_yH_z$ and wherein $x \geq 1.2y$ (specification page 11, line 24).

Claim 135 is the method of Claim 107where the intermediate layer comprises at least one of Si_vN_w and of $Si_vN_wH_u$ and wherein $v \geq 1.2w$ (specification page 11, line 24).

Claim 136 is the method of Claim 107 where the intermediate layer comprises SixCyHz and wherein there is valid: $x \leq 0.8$, $y \geq 0.05$ and $z \geq 0.1$ (specification page 12, line 7).

Claim 137 is the method of Claim 107 where the intermediate layer comprises at least one of $Si_vN_wH_u$ and Si_vN_w and wherein there is valid: $v \leq 0.8$ and $w \geq 0.05$ (specification page 12, line 10).

Claim 138 is the method of Claim 107 where the intermediate layer comprises at least one of Si_xC_y and $Si_xC_yH_z$ and wherein there is valid: $\{0.445:0.262\} \leq \{x:y\} \leq \{0.775:0.078\}$ (specification page 12, line 12).

Claim 139 is the method of Claim 107 where the intermediate layer comprises at

least one of Si_xC_y and $Si_xC_yH_z$ and wherein there is valid: $\{0.445:0.249\} \le \{x:z\} \le \{0.775:0.118\}$ (specification page 12, line 16).

Claim 140 is the method of Claim 107 where the intermediate layer comprises at least one of Si_xC_y and $Si_xC_yH_z$ and wherein there is valid: $\{0.078:0.249\} \le \{y:z\} \le \{0.262:0.118\}$ (specification page 12, lines 20-21).

Claim 141 is the method of Claim 107 where the said intermediate layer at least predominantly consists of $Si_xC_yH_z$ and wherein there is valid: $x:y:z=0.704$ ($\pm10\%$):0.087 ($\pm10\%$):0.131 ($\pm10\%$), wherein $\pm10\%$ indicates the statistic dispersion of multiple measurements of the values (specification page 13, lines 3-8).

Claim 142 is the method of Claim 107 where the intermediate layer at least predominantly consists of SixCyHz and wherein there is valid: $x:y:z=0.494$ ($\pm10\%$):0.238 ($\pm10\%$):0.226 ($\pm10\%$), wherein $\pm10\%$ indicates the statistic dispersion of multiple measurements of said values (specification page 13, lines 3-11).

Claim 143 is the method of Claim 107 where the intermediate layer comprises at least one of Si_vN_w and $Si_vN_wH_u$ and wherein there is valid: $\{0.527:0.401\} \le \{v:w\} \le \{0.858:0.099\}$ (specification page 13, line 12).

Claim 144 is the method of Claim 107 where the intermediate layer comprises at least one of SivNw and $Si_vN_wH_u$ and wherein there is valid: $\{0.527:0.044\} \le \{v:u\} \le \{0.858:0.009\}$ (specification page 13, line 12).

Claim 145 is the method of Claim 107 where the intermediate layer comprises at least one of Si_vN_w and $Si_vN_wH_u$ and wherein there is valid: $\{0.099:0.044\} \le \{v:u\} \le \{0.401:0.009\}$ (specification page 13, line 20).

Claim 146 is the method of Claim 107 where the intermediate layer comprises at least one of Si_vN_w and $Si_vN_wH_u$ and wherein there is valid: $v:w=0.78$ ($\pm10\%$):0.11 ($\pm10\%$), wherein $\pm10\%$ indicates statistic dispersion of multiple measurements (specification page 14, lines 1-3).

Claim 147 is the method of Claim 107 where the intermediate layer comprises at least one of SivNw and Si $_v$N$_w$H$_u$ and wherein there is valid: v:w=0.586 (±10%):0.364 (±10%), wherein ±10% indicates statistic dispersion of multiple measurements (specification page 14, lines 1-8).

Claim 148 is the method of Claim 107 where at least three of the solid material interfaces are provided on one side of a carrier substrate (Fig. 3).

Claim 149 is the method of Claim 107 where an information storage capacity per side of the carrier substrate is at least 11 GByte at a diameter of a circular carrier of 120 mm (specification page 20, lines 15-20).

VI   ISSUES (37 C.F.R. 1.192(c)(6))

The issues of this appeal are as follows, in the order of the rejections in the Final Rejection:

Whether claims 91, 98, 99 and 103-105 are patentable under 35 U.S.C. 103 over U.S. Patent 5,414,678 to Challener, IV in view of U.S. Patent 5,240,581 to Kim.

Whether claims 95 and 100 are patentable under 35 U.S.C. 103 over Challener, IV in view of Kim, and further in view of U.S. Patent 5,292,417 to Kugler.

Whether claims 96 and 97 are patentable under 35 U.S.C. 103 over Challener, IV in view of Kim in view of Kugler, and further in view of European Patent Application EP 0 564 789 to Signer.

Whether claims 101 and 102 are patentable under 35 U.S.C. 103 over Challener, IV in view of Kim, and further in view of Japanese Patent JP 59-73413 to Takei et al.

Whether claims 92, 93 and 106 are patentable under 35 U.S.C. 103 over Challener, IV in view of European Patent Application EP 0 473 492 to Tawara et al.

Whether claims 94, 95 and 98-100 are patentable under 35 U.S.C. 103 over Challener, IV in view of Tawara et al., and further in view of Kugler.

Whether claims 96 and 97 are patentable under 35 U.S.C. 103 over Challener, IV in view of Tawara et al. in view of Kugler, and further in view of Signer.

Whether claims 107-118, 123-125, 130-135, 137-140 and 143-149 are patentable under 35 U.S.C. 103 over Challener, IV.

Whether claims 119, 120, 126 and 127 are patentable under 35 U.S.C. 103 over Challener, IV in view of European Patent Application EP 0 658 885 to Imaino et al.

Whether claims 121 and 122 are patentable under 35 U.S.C. 103 over Challener, IV in view of U.S. Patent 4,428,811 to Sproul et al.

Whether claims 128 and 129 are patentable under 35 U.S.C. 103 over Challener, IV in view of Kugler.

Whether claims 136, 141 and 142 are patentable under 35 U.S.C. 103 over Challener, IV in view of Tawara et al.

VII   GROUPING OF CLAIMS (37 C.F.R. 1.192(c)(7))

It is applicant's position that the claims as grouped by the Examiner do not all stand or fall together. The grouping of claims which are believed to be patentable distinct from each other, are as follows:

Group A: Claims 91, 103/91 and 104/91 (Claim 91 is a method for producing a carrier having two or more solid material interfaces containing information, with an intermediate layer between; comprising depositing in the intermediate layer, a layer of predominantly Si_vN_w by reactive vacuum coating with step of freeing Si from solid body into process atmosphere with reactive gas containing N; Claim 103/91 is the method of Claim 91 where reactive gas includes Nitrogen; and Claim 104/91 is the method of Claim 91 where information is

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characteristic electromagnetic reflection of the interfaces).

Group B: Claims 92, 103/92 and 104/92 (Claim 92 is a method for producing carrier having two or more solid material interfaces containing electro-magnetic radiation reflection information with intermediate layer between, the information being readable by radiation of predetermined wavelength; comprising depositing in the intermediate layer, a layer of predominantly $Si_vN_wH_u$ by reactive vacuum coating in a process atmosphere, optimum of transmission and refractive index being achieved by adjusting concentration of reactive gas of N and H in the process atmosphere; Claim 103/92 is the method of Claim 92 where the reactive gas includes Nitrogen; and Claim 104/92 is the method of Claim 92 where the information is characteristic electromagnetic reflection of the interfaces).

Group C: Claim 93 (method of Claim 92 where Si is freed from a solid body).

Group D: Claim 94 (method of Claim 92 where process gas consists of different ratios of C to H content and/or N to H content, where optimum is either open-loop or negative-feedback controlled by adjusting ratio of two gases in the process atmosphere.

Group E: Claim 95 (method of Claims 91 or 92, including applying DC-voltage with superimposed AC-voltage between workpiece carrier and electrode in the vacuum process atmosphere).

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Group F: Claims 96 and 97 (Claim 96 is method of Claim 95 where AC-voltage is pulsating; and Claim 97 is method of Claim 95 where AC-voltage is generated by intermittently connecting carrier and electrode via first and second current paths of different resistance).

Group G: Claims 98, 99 and 100 (Claim 98 is method of Claims 91 or 92 where reactive sputtering or ion plating are used; Claim 99 is method of Claim 98 where sputtering is magnetron sputtering; and Claim 100 is method of Claims 91 or 92 where negative or positive doped silicon target is reactively sputtered or ion plated or magnetron sputtered).

Group H: Claims 101 and 102 (Claim 101 is method of Claims 91 or 92 where reactive gas is hydronitrogen; and Claim 102 is method of Claims 91 or 92 where reactive gas is Ammonia).

Group I: Claim 105 (method of Claims 91 or 92 where intermediate layer comprises dielectric layer system that has an optical thickness which is about $m \cdot \lambda_o/4$, where m is uneven integer of at least unity and wherein λ_o is wavelength of radiation transmitted through the layer system).

Group J: Claim 106 (method of Claims 91 or 92 including applying silver layer between one of the solid material interfaces and the intermediate layer).

Group K: Claim 107 (method for producing information carrier having two or

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more solid material interfaces containing information with an intermediate layer between; comprising depositing the intermediate layer to have a layer system with at least one dielectric layer and with an optical thickness which is $m.\lambda_0/4$ wherein m is an uneven integer of at least unity and where λ_0 is the wavelength of radiation which is transmitted through the dielectric layer and where m is reduced by up to 0.6 or increased by up to 0.2).

Group L: Claims 108, 114, 116 and 131 (Claim 108 is method of Claim 107 including electromagnetic radiation for applying or reading information having wavelength of 400nm $\leq \lambda_s \leq$ 800nm; Claim 114 is method of Claim 113 where first wavelength is approximately 635 or 650 nm; Claim 116 is method of Claim 113 where second wavelength is approximately 785 nm; and Claim 131 is method of Claim 107 where radiation in blue spectral range of 400 $\leq \lambda_s \leq$ 500 nm performs reading and/or writing of information).

Group M: Claims 109, 113 and 117 (Claim 109 is method of Claim 107 where at least one of the interfaces has reflection of 20% to 40% for a selected wavelength of said radiation; Claim 113 is method of Claim 107 where reflection of radiation of second wavelength at first interface is significantly lower than radiation of first wavelength; and Claim 117 is method of Claim 113 where reflection of second wavelength radiation at first interface is 10% at most).

Group N: Claims 110 and 118 (Claim 110 is method of Claim 107 where

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intermediate layer has index of refraction greater than or equal to 2.59 and less than or equal to 4.6 and extinction coefficient of less than or equal to 3.0; and Claim 118 is method of Claim 107 where the index of refraction n_1 of intermediate layer is: $2.59 \le n_1 \le 4.6$ or the extinction coefficient k of intermediate layer is $k_{300\,nm} \le 3.0$).

Group O: Claim 111 (method of Claim 107 where dielectric is silicon carbide Si_xC_y or silicon nitride Si_vN_w).

Group P: Claim 112 (method of Claim 107 where modulated characteristic is thickness of solid material body defining solid material interfaces).

Group Q: Claim 115 (method of Claim 113 where intermediate layer is dielectric layer with optical thickness of approximately uneven multiple of quarter of first or second wavelengths and is at least approximately an even multiple of quarter of the other wavelength).

Group R: Claims 119 and 120 (Claim 119 is method of Claim 107 where intermediate layer has a spacer layer; and Claim 120 is method of Claim 119 wherein spacer is lacquer and/or glue).

Group S: Claims 123, 124, 125, 126 and 127 (Claim 123 is method of Claim 107 where one interface is between intermediate layer and a plastic material or between intermediate layer and a spacer layer or between intermediate layer and a high reflecting cover layer; Claim 124 is method of Claim 123 where the plastic is polycarbonate or PMMA or

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the spacer layer is lacquer or glue, or the high reflecting cover layer is Al or Au or Ag; Claim 125 is method of Claim 124 where high reflecting cover layer is Al; Claim 126 is method of Claim 107 where one interface is formed at a lacquer surface; and Claim 127 is method of Claim 126 where the lacquer is uv-hardenable).

Group T: Claims 121 and 122 (Claim 121 is method of Claim 107 where dielectric layer is ZrN or HfN or TiN; and Claim 122 is method of Claim 121 where dielectric layer is of ZrN).

Group U: Claims 128, 129 and 130 (Claim 128 is method of Claim 107 where intermediate layer is semiconductor doping material; Claim 129 is method of Claim 128 where doping material is Boron or Phosphor; and Claim 130 is method of Claim 107 wherein intermediate layer is C and forms at least one interface with a further material which contains C).

Group V: Claims 132 to 147 (methods where intermediate layer is Si_xC_y or $Si_xC_yH_z$ or Si_vN_w or $Si_vN_wH_u$ and relative values for x, y, z, v and u are defined).

Group W: Claims 148 and 149 (Claim 148 is method of Claim 107 where at least three interfaces are provided on one side of carrier substrate; and Claim 149 is method of Claim 107 where information storage capacity per side of carrier substrate is at least 11 GByte for circular carrier of 120 mm diameter).

VIII ARGUMENTS

VIIIA ARGUMENTS - REJECTIONS UNDER 35 U.S.C. 112 FIRST PARAGRAPH (37 C.F.R. 1.192(c)(8)(i))

There has been no rejection of the claims under 35 U.S.C. 112, first paragraph.

VIIIB ARGUMENTS - REJECTIONS UNDER 35 U.S.C. 112 SECOND PARAGRAPH (37 C.F.R. 1.192(c)(8)(ii)

There has been no rejection of the claims under 35 U.S.C. 112, second paragraph.

VIIIC ARGUMENTS - REJECTIONS UNDER 35 U.S.C. 102 (37 C.F.R. 1.192(C)(8)(iii)

There has been no rejection of the claims under 35 U.S.C. 102.

VIIID ARGUMENTS - REJECTION UNDER 35 U.S.C. 103 (37 C.F.R. 1.192(c)(8)(iv)

All of claims 91 to 149 have been rejected under 35 U.S.C. 103, and detailed arguments are presented after the next section of this brief.

VIIIE ARGUMENTS - REJECTION OTHER THAN UNDER 35 U.S.C. 102, 103 AND 112 (37 C.F.R. 1.192(c)(8)(v)

There has been no other ground for rejection.

A. Introduction

The Examiner has rejected all of the claims on appeal as being obvious from U.S. Patent 5,414,678 to Challener IV, taken alone of in combination with one or more secondary references.

It is believed that after considering the following, the Board will agree that the invention claimed on appeal would not be obvious to the person of ordinary skill in this art,

and that accordingly all of the claims should be allowed.

B.   The Prior Art

1.   U.S. Patent 5,414,678 to Challener, IV

Challener IV (or simply Challener in the following) discloses a magnet-optic recording medium 12 having two information carrying layers 18 and 22 that are separated by dielectric layers 16, 20 and 22, from each other and from a lower transparent substrate 14 and an upper reflecting layer 26. These features are all shown in Fig. 1 of the reference which is reproduced below, with labels to expediting understanding of the reference.

Challener teaches that the dielectric layers may each comprise silicon nitride, silicon carbide, silicon oxide, ytrium oxide, aluminum nitride, silicon aluminum oxinitride, or similar materials (column 4, lines 63-67).

Challener teaches this list of possible materials without giving

FIG.1

any preference as to which materials should preferably be used. From this list of multiple specified materials, and "similar materials," there is no suggestion to select silicon nitride specifically (Claim 91), or $Si_vN_wH_u$ at all (Claims 92), nor to relate the layer thickness to the wavelength of light used to read the inner information layer (Claim 107), as will be
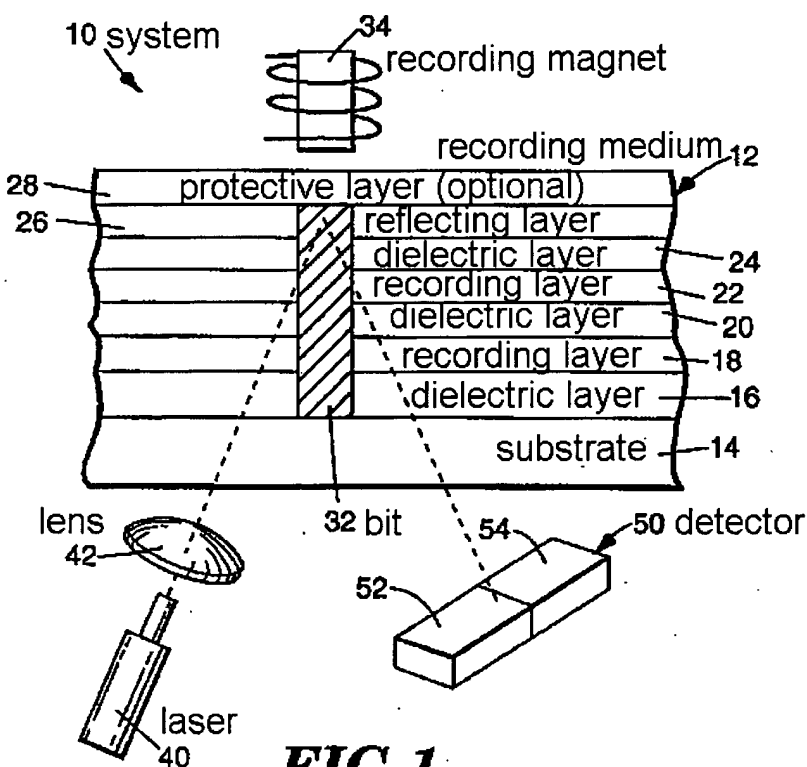
discussed later in this brief.

Challener is also silent as to how its alternating repetition of dielectric/magneto-optic layers 16, 18, 20, 22 and 24 are to be formed.

There is no teaching in Challener that depositing at least one layer that is predominantly Si_vN_w in the intermediate layer by means of a reactive vacuum coating process by freeing Si from a solid body into a process atmosphere with a reactive gas containing N, is useful (Claim 91).

Neither does Challener teach how the intermediate layer should be deposited nor that $Si_vN_wH_u$ should be deposited at all (Claim 92). Challener does not specifically teach the use of SiNH, which could possibly only be considered as one of the "similar materials," as taught by Challener at column 4, line 66.

Challener also does not teach how to tailor the thickness of the intermediate layer in relation to the wavelength of radiation being used for reading the carrier information. Thus, although Challener teaches a thickness range of 10 to 150 nm for such intermediate layer(s) (column 4, line 68), it does not suggest observing a relation between the thickness of such layer and the wavelength of reading radiation. Challener teaches other ways to determine the thickness of the intermediate layer in the example starting at column 5, line 50, but does not recognize the usefulness of the reading radiation (light) wavelength to calculate the thickness, nor that when applying such wavelength parameter, one may depart from accurately selecting "m" to be an integer (as is known from interference filtering art) by the amount as claimed (m - 0.6m $\leq$ m $\leq$ m + 0.2m), thereby significantly simplifying the depositing step for such layer but still achieving proper optical qualities for the layer.

Thus, in spite of applying interference filtering techniques that may be know from outside Challener, the requirements for establishing an accurate thickness of such layer with respect to the wavelength of the reading radiation may be loosened by the invention.

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2.   U.S. Patent 5,240,581 to Kim

Kim discloses a reactive sputtering method for producing a magneto-optical disk with one information layer that is covered by a protective layer of silicon nitride (column 3, lines 20-42). Kim states that it is know to use protective layers of SiO, SiO_2, Si_3N_4, ZnS or AlN as well (column 1, line 34). Reactive sputtering is a reactive vacuum coating process, and Kim teaches the step of freeing silicon from a solid body in Example 1 to form the protective layer.

The major concern of Kim is to control the refractive index of the protective layer (column 1, lines 8-9, 39-41, 49-50 and 60-61, and column 1, line 64 to column 2, line 2) and he teaches that this is done by changing the flow rate of argon in the process, while keep the flow rate of nitrogen constant (column 2, lines 3-14).

Kim teaches that RF power with DC power are both preferably applied to the sputter target, that varying the nitrogen flow is not good for refractive index control and that keeping the argon flow constant is not good for refractive index control (column 4, line 37 to column 5, line 22 - the comparative examples).

Kim is silent as to whether his silicon nitride deposition technique would be suitable for an intermediate layer between two information carrying layers where reflected information carrying light must pass through at least one other information layer before reaching the intermediate layer, and then pass through the other information layer again, before it is read. This places much greater reliance on the optical characteristics of the intermediate layer than contemplated by Kim, which only expects the information carrying light to pass though one or more protective layers before it is read.

Also, although Kim makes reference to a Fig. 1 which purports to illustrate the disk and its layers, no such figure is in Kim. The two sheets of drawings ("Sheet 1 of 2" with Fig. 2, and "Sheet 2 of 2" with Figs. 3 and 4) are the only drawings and they contain no Fig. 1.
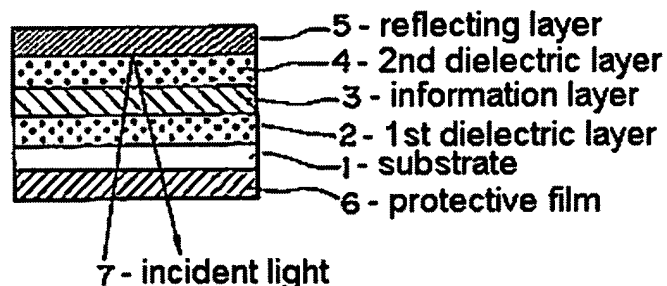
Accordingly, the person of ordinary skill in this field would only have the Kim text to go on for understanding the structure of the disk layers in Kim, and there is no suggestion in Kim that two information layers can be used, nor that the protective layer of Kim, despite its well controlled refractive index, would be suitable to separate two information layers from each other.

3.   European Patent Application EP 0 473 492 to Tawara et al.

The Tawara et al. reference (or Tawara in the following), discloses the structure for, and method of making a magnet-optical recording medium with a single information layer 3 shown in Fig.1 of the reference, which is reproduced below with labels.

Dielectric layers 2 and 4 are on opposite sides of the information layer 3 and a protective coating film 6 of particular character is formed on an opposite side of the substrate 1 of the medium, from the first dielectric layer 2.

Dielectric layer 2 in Tawara, like the protective layer of Kim, passes information carrying light 7 of only one information layer so that its optical characteristics are not as critical as in Challener and as in the present invention. In Challener and in the present invention the intermediate layer between two

5 - reflecting layer
4 - 2nd dielectric layer
3 - information layer
2 - 1st dielectric layer
1 - substrate
6 - protective film

7 - incident light

information carrying layers must accurately pass light with information of one layer, even though that light has also passed through at least one other information layer.

Tawara teaches that the first dielectric layer 2 is 20 to 300 nm thick (column 3, line 2), is made by sputtering (column 4, line 26) and can be "silicon nitride, silicon carbide, silicon nitride containing hydrogen, silicon carbide containing hydrogen, silicon carbide nitride containing hydrogen and the like" (column 2, line 56 to column 3, line 2).

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Little attention is paid to the characteristics of layer 2 since the main thrust of the reference deals with the formation, composition and character of the outer protective film 6 which is on the opposite side of substrate 1 (see Tawara at column 3, lines 26-41 and the examples starting at column 4, line 19).

4. European Patent Application EP 0 658 885 to Imaino et al.

Imaino et al. (or Imaino in the following) teaches a multiple data surface medium where, like in Challener and in the present invention, information carrying light must pass through other information layers and still be readable.

The lengthy Imaino reference teaches various aspects of the art, including the usefulness of spacer layers 122 of optical cement between data layers 94' and 96' in Fig. 2B of the reference which is reproduce below (page 4, lines 38-40 of the reference).

optical cement spacers — data surfaces —
120 — (122)   (94' and 96')
FIG. 2B
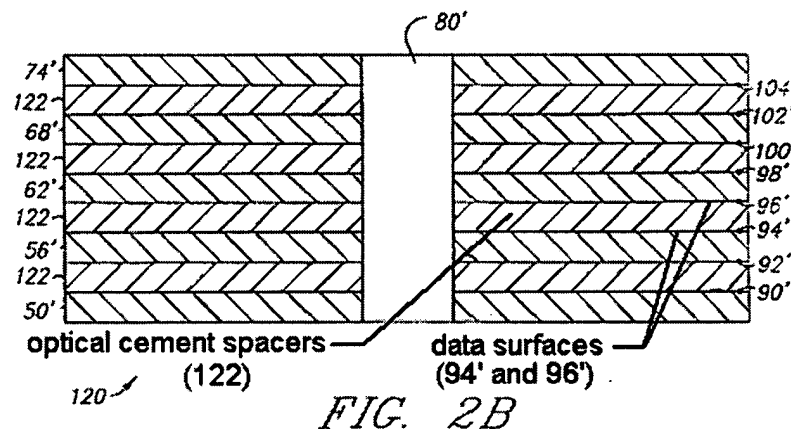
Although Imaino uses neither the words "glue" nor "lacquer" in connection with spacer layers 122, these terms as used in certain of the dependant claims on appeal here, are meant to generally cover, or be equivalent to, any optical cement contemplated by those skilled in the art reading the Imaino reference. Also, Imaino teaches that such a spacer layer 122 may be part of an intermediate layer system that includes an optically active (e.g. silicon) layer 124' in Fig. 3B of the reference (page 5, lines 5-8).

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Thus, although Imaino suggests the usefulness of a cement spacer layer as part of an intermediate layer between information or data layers, this reference should be taken as a whole for what it teaches those skilled in this art.

At page 2, lines 35-37, Imaino teaches that there are problems when trying to include multiple data layers in a single storage medium. Speaking of the prior art to Imaino, the references states:

"The problem with these prior art systems has been that the ability to clearly read the data recorded is very difficult if there is more than one data layer. Intervening data layers greatly reduce the signal received from the deeper data layers due to absorption and reflection losses."

Neither Kim nor Tawara can be read to solve these problems because they do not deal with multiple data layers. Challener does deal with these problems but does not teach the present invention.

Looking further to Imaino for more of its teaching on how to solve the problem of forming intermediate layers between the data layers, Imaino discloses the importance of highly transmissive intermediate layers 124 with high index of refraction for light of the relevant wavelength (page 5, lines 9-15). Imaino also teaches that semiconductor materials deposited by a sputtering process satisfy these requirements (page 5, lines 23-42) and treats amorphous silicon with some detail. The extensive list of other semiconductor materials disclosed, however, does not include $Si_vN_wH_u$ nor is a sputtering process from pure Si in a reactive gas containing nitrogen taught, nor is depositing an intermediate layer of a thickness calculated on the basis of the wavelength taught.

While it is appreciated that the Imaino reference was cited only for its teaching of the spacer layers, it should also be take for the fact that it combines that teaching with

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contrary teaching regarding the claimed invention, and should be taken as a whole for what it suggested to those skilled in the art.

5.   U.S. Patent 4,428,811 to Sproul et al.

Sproul et al. (or simply Sproul) discloses "a reactive sputtering apparatus 10 for plating of a thin film of titanium nitride (TiN) or other similar metal" including ZrN (zirconium nitride) and HfN (hafnium nitride) (column 2, lines 41-49).

The only examples give by Sproul are the hard coatings on metal cutting tools (column 8, lines 17-24).

While Sproul teaches that the disclosed method has high deposition rate and controlled stoichiometry (column 8, lines 15-17), nothing in Sproul suggests that TiN or ZrN or HfN can be made transparent, or even more importantly, have the optical characteristics that make it suitable as an intermediate layer in a multi-information layered medium, or the desired thickness of such a layer, or that the thickness should be bases on the wavelength of light that passes through the layer.

Sproul's use of the word "thin" for the layer thickness is relative and the word "hard" for the character of the layer is in the sense of metal cutting tools and not in the sense of plastic information carries which are not in the same field.

6.   U.S. Patent 5,292,417 to Kugler

Kugler (U.S. Patent 5,292,417), which was invented by the inventor of the claims on appeal here, discloses additional process techniques for the reactive vacuum sputtering of layers onto a substrate or workpiece. Kugler's method is particularly useful for the deposition of dielectric layers which have low conductivity (column 1, lines 6-17) and does so using superimposed AC and DC power and other techniques that are also used in some of the claims on appeal. Kugler also teaches that these techniques are useful for

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depositing layers in optical devices (column 7, lines 12-16) and that such layers may be of Si_3N_4 (column 15, line 25).

Kugler does not suggest that an intermediate layer in a multi-information layer medium should be made using his techniques, nor other important features of the invention.

7.   Japanese Patent JP 59-73413 to Takei et al.

Takei et al. (Takei in the following) teaches a vacuum sputtering deposition process that uses nitrogen (N) or ammonia (NH_3) as the reactive gas to deposit silicon nitride having selected denseness and insulating properties.

The creation of intermediate layers in optical devices, in particular between information layers, is not apparently discussed, nor is the depositing of $Si_vN_wH_u$ layers or any layers with specific optical characteristics.

8.   European Patent Application EP 0 564 789 to Signer

Signer is equivalent to U.S. Patent 5,948,224 which can serve as an English translation thereof. A copy of U.S. Patent 5,948,224 accompanies each copy of this brief and will also be referred to as Signer.

Signer discloses a method for reactive vacuum depositing dielectric layers which includes interrupting the application of DC-voltage and/or intermittently connecting the AC-voltage to high and low resistance paths for avoiding the danger of arcing during the process, and the resulting damage to the layer being deposited.

While the deposition of optically active layers is contemplated (column 35, lines 51-54 of U.S. Patent 5,948,224), Signer does not suggest that the extremely critical optical characteristics of an intermediate layer between information carrying layers can be, or should be met using his teaching.

C. Discussion

The level of ordinary skill in this art of vacuum vapor deposition generally, and the making of information carriers in particular, is high.

The technology is complex and the body of prior art is dense with teachings of materials, methods of forming and depositing the materials, and characteristics that are sought after and achieved by these methods. The finished products in the general field include hard metal tools with even harder coatings such as in Sproul, and much more delicate CDs, DVDs and other information carriers of plastic with complex layers for information and protection, with exotic radiation transmitting qualities such as in Challener and Imaino.

Within this framework, the person of ordinary skill in the art of information carriers in particular, is aware of the challenges and the difficulties of navigating in and among the teachings of the prior art to solve problems and make useful products, and in the case of information carriers, millions of such products.

Group A - Claims 91, 103/91 and 104/91

In reply to the rejection of these claims as being an obvious combination of Challener and Kim, it is emphasized that Challener does teach an intermediate layer 20 between two information layers 18 and 22 of the reference, but does not teach or suggest "depositing in said intermediate layer at least one layer at least predominantly comprising Si_vN_w by means of a reactive vacuum coating process, comprising the step of freeing Si from a solid body into a process atmosphere with a reactive gas containing N."

Challener does suggest using SiN as one among several possible materials for the intermediate layer (the special case where $v = w = 1$ for Si_vN_w) but not the method for depositing the layer. Even for the detailed case disclosed by Challener in the example starting at column 5, line 50, silicon carbide is the material and no method of depositing

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the material is disclosed.

Imaino like Challener teaches the critical nature of the intermediate layer.

Kim teaches depositing a protective layer of Si_3N_4 (v = 3 and w = 4 in Claim 91 but for the intermediate layer claimed, not for a protective layer) by means of a reactive vacuum coating process comprising the step of freeing Si from a silicone target (column 4, line 13) into a process atmosphere with a reactive gas containing N (column 4, line 16).

The reference also discusses the criticality of controlling refractive index for the protective layer (column 2, line 6) and, in the comparative examples, shows who easy it is to produce unacceptable layers by varying the flow of the wrong gas or by powering the deposition process in the wrong way (starting at column 4, line 50).

Challener and Imaino already explain how much more critical the characteristics of an intermediate layer between information layers are, and Kim shows how difficult it is to reach the required characteristics of a protective layer.

Thus, Challener combined with Kim seems to teach to the skilled artisan that reaching any required refraction level is difficulty, and, in view of the difficulty in reaching the required level for protective layers is Kim, use of the Kim method to reach the even higher requirements of intermediate layers is not believed to be obvious.

Group B - Claims 92, 103/92 and 104/92

Replying to the rejection of Claim 92 as being an obvious combination of Challener and Tawara, it is noted that Challener does not teach or suggest "depositing in said intermediate layer at least one layer at least predominantly comprising $Si_vN_wH_u$ by means of a reactive vacuum coating process in a process atmosphere, an optimum of transmission of said layer and of a refractive index of the material of said layer being achieved by adjusting the concentration of a reactive gas in the process atmosphere, which reactive gas comprises N and H." The usefulness of $Si_vN_wH_u$ as a material of the

intermediate layer is nowhere suggested by Challener and in view of the criticality of the intermediate layer, would not be used by the person of ordinary skill in this art without some clear teaching.

Tawara suggests a material called "hydrogen-containing silicon nitride" (column 4, lines 49-50) for an outer protective layer in a single information layer medium, and sputtering (a form of vacuum coating) to deposit this layer. Reactive sputtering may even be implied because of the compositions of the protective layers disclosed in Tawara, but Tawara does not expressly teach reactive gases comprises N and H. Tawara also has comparative examples showing how easy it is to loose the desired characteristics.

Thus, In view of the even higher criticality of the optical characteristics of an intermediate layer, the combination of Challener and Tawara would not render Claims 92, 103/92 or 104/92 obvious.

Group C - Claim 93

This claim, also rejected as obvious from Challener in view of Tawara, calls for Si to be freed into the process atmosphere from a solid body for the reactive process. Although taught by Kim, this feature is not taught by Tawara and cannot be obvious for a combination of two references which neither teach the claim limitation.

Group D - Claim 94

This claim, as well as Claims 95 and 98-100, were rejected as being obvious from Challener in view of Tawara and further in view of Kugler.

Claim 94 further limits Claim 92 by requiring the gas in the process atmosphere to predominantly consist of two different gases with either a ratio of C (carbon) to H (hydrogen) content, or of N (nitrogen) to H (hydrogen) content in the gas, and where optimum radiation (light) transmission and refraction is either open-loop- or negative-

feedback-controlled by adjusting the ratio of the gases.

No gas ratio control is taught or suggested by Challener or Tawara.

In Kugler at column 12, lines 25-61, a long list of parameters that can be controlled is disclosed, including "mass flow rate of process gas (= working gas + reactive gas)" (lines 57-58). This is believed insufficient teaching in combination with Challener and Tawara to reach Claim 94 in an obvious manner, however.

The gases of Kugler are oxygen (column 11, line 52) and argon (column 12, line 7) and neither carbon, nitrogen nor hygrogen is mentioned. Also, neither Tawara nor Kugler contemplate the strict requirements of an intermediate layer so that this combination of three references is believed to be insufficient to reach claim 94.

Group E - Claim 95

Claim 95, further limiting either Claim 91 or Claim 92 by applying a DC-voltage and superimposed AC-voltage between a workpiece carrier and an electrode in a vacuum atmosphere of the process, was rejected as being obvious either from Challener in view of Kim and further in view of Kugler; or from Challener in view of Tawara and further in view of Kugler.

Kugler is the only reference in these two combinations teaching the DC with superimposed AC powering of carrier and electrode. Kugler also teaches the applicability of its teaching in general the optical devices (column 7, line 16) and provides values of certain optical characteristics such as absorption coefficient and refraction index for layers of SiO_2 (column 14, lines 40-43).

In view of the unpredictability of the various techniques to produce layers of sufficient optical quality even for protective layers (see the comparative examples of Tawara and Kim), and the even greater requirements for intermediate layers between information layers (Challener and Imaino), the person of ordinary skill in this art would not

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find Claim 95 obvious from either cited combination of three references.

Group F - Claims 96 and 97

These claims further limit Claim 95 by calling for the pulsing or intermittent interrupting of power generally taught by Signer, and were rejected as obvious from either Challener in view of Kim, in view of Kugler and further in view of Signer; or Challener in view of Tawara, in view of Kugler and further in view of Signer.

Signer like Kugler, seems to have wide application in general but only mentions its usefulness for making optical layers once (column 35, line 54) and disclosed refraction and extinction characteristics for an SiO_2 layer (column 26, lines 34-37).

Like Tawara, Kugler and Kim, it does not mention the more critical requirements of an intermediate layer as set out in Challener and Imaino so that again Claims 96 and 97 are not believed to be obvious from either of these combinations of four references.

Group G - Claims 98, 99 and 100

These claims which all deal with the selection of which type of reactive vacuum deposition process to use, have been rejected as obvious from the combination of Challener, Tawara and Kugler, or as obvious from the combination of Challener and Kim in the case of Claims 98 and 99, or from the combination of Challener, Kim and Kugler for Claim 100.

Kugler does teach doping of the silicon target (Claim 100) as well as sputtering but not ion plating. Tawara and Kim teach sputtering but no doping or ion plating and Challener teaches neither sputtering nor ion plating nor target doping.

In view of the critical nature of the intermediate layer between information layers, it is not seen how the skilled artisan would reach these claims in an obvious manner from these combinations of references.

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Group H - Claims 101 and 102

These claims dealing with the reactive gas of hydronitrogen or ammonia (NH_3) were rejected as obvious from Challener with Kim and Takei.

According to Takei, an insulating film of silicon nitride is formed by sputtering with ammonia and nitrogen. Neither Takei nor Kim teach the criticality of forming an intermediate layer between information layers as in Challener, so that the skilled artisan must simply guess that ammonia plus nitrogen or hydrogen with nitrogen as the reactive gases would work.

This is just an invitation to try out the various techniques, not an obvious combination of references that reach the claims.

Group I - Claim 105

This claim, rejected as obvious from Challener in view of Kim, called for the method of Claims 91 or 92, with a dielectric layer system of at least one layer, where this layer system has an optical thickness which, at least in a first approximation, is $m \cdot \lambda_0/4$, where m is an uneven integer of at least unity and where λ_0 is the wavelength of the radiation which is transmitted through the dielectric layer.

Here, the thickness of a critical part (or all) of the intermediate layer is set in terms of the wavelength of the reading or writing radiation (light) for at least the inner information layer. Neither Challener nor Kim suggest this requirement so that their combination can not supply the missing feature in any obvious way.

Group J - Claim 106

Claim 106 calls for the use of silver at one of the information surfaces defined by either Claim 91 or Claim 92. It is not believed that this claim is obvious from Challener taken with Tawara as in the final rejection because, although Tawara teaches a reflective

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silver layer 5 behind its one information layer 3, this is not the same as a silver layer at an information interface as in Claim 106.

Both Challener and Tawara disclose magneto-optical layers where the information is stored in the body of the layer rather than at an interface. The limitation of Claim 106 would have no meaning in either reference.

Group K - Claim 107

This is the third independent claim on appeal and has been rejected as obvious from Challener taken alone.

Claim 107 is believed to be clearly unobvious and patentable over Challener because, except for calling for the intermediate layer to contain dielectric material, Challener is missing the entire novel combination of features claimed, namely: "depositing the intermediate layer to have a layer system with at least one dielectric layer and with an optical thickness which, at least in a first approximation, is $m.\lambda_o/4$, wherein m is an integer of at least unity and is uneven and wherein λ_o designates the wavelength of said radiation which is transmitted through said at least one dielectric layer and wherein, depending from said m being an integer, m being reduced by an amount of up to 0.6 or increased by an amount of up to 0.2."

Neither the calculation for the layer thickness is taught be Challener, nor the expanded tolerance for "m" which makes the method of the claimed invention easier to perform while still producing functional information carriers.

Group L - Claims 108, 114, 116 and 131

These claims fine-tune the dielectric layer thickness by particularly defining the wavelength ranges and thus establish both the thicknesses that will work for the invention and the type of light to be used to read and write at least the inner information layer.

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Although these claims have all been rejected as obvious from Challener, Challener does not disclose the wavelength of radiation to be used and certainly does not disclose the usefulness of this wavelength to determine the thickness of the dielectric layer to be between the two information layers.

Accordingly these claims can not be obvious from Challener.

Group M - Claims 109, 113 and 117

Claims 109, 113 and 117, quantify the reflection of radiation at one or both of the information interfaces which depends on the characteristics of the information interfaces and/or the intermediate layer. All are rejected as obvious from Challener which discloses nothing about the reflection of radiation at the information layers. The light path 7 in Fig. 1 of Challener seems to imply no reflection in the information layers at all, only at the upper reflecting layer 26.

Thus, it is believed that these claims are all patentable over Challener.

Group N - Claims 110 and 118

These claims quantify the optical qualities of the intermediate layer and are rejected as obvious from Challener which disclosed the desirability of having good optical qualities in the intermediate layer, but does not disclosed or suggest acceptable values therefor and thus should be insufficient to render these claims obvious.

Group O - Claim 111

Claim 111 further limits Claim 107 by requiring the dielectric layer to be silicon carbide Si_xC_y or silicon nitride Si_vN_w and is rejected as obvious from Challener.

Challener does teach SiC_x and SiN as possible materials for the intermediate dielectric layer 20 but does not generalize this to other compounds of silicon with carbon,

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or silicon with nitrogen. Nor are the thickness calculations of Claim 107, found in or obvious from Challener. Accordingly this claim is also believed to be patentable over Challener.

Group P - Claim 112

This claim, also rejected as obvious from Challener, further limits Claim 107 by calling for the locally modulated characteristic to be the thickness of the solid material body defining at least one of the interfaces.

No such thickness variation is suggested by Challener which relies on differences in magnetic character in the information layers to store information so that this claim distinguished the invention even further from Challener.

Group Q - Claim 115

Claim 115, rejected as obvious from Challener, defines the method of Claim 113 where the intermediate layer comprises at least one dielectric layer having an optical thickness which is an at least approximately uneven multiple of a quarter of one of said first and second wavelengths and is at least approximately an even multiple of a quarter of the other of said first and second wavelengths.

This is a further distinction over Challener which is clearly unobvious.

Group R - Claims 119 and 120

These claims introduce the spacer layer as part of the intermediate layer, and the fact that it can be made of laquer or glue. Both rejected as obvious from Challener with Imaino which teaches an intermediate layer including a cement spacer; neither discusses the criterion for the intermediate layer thickness as a function of wavelength.

Accordingly these claims are also believed to be unobvious over the cited

combination.

Group S - Claims 123 to 127

These claims are rejected as obvious from Challener alone, or the combination of Challener with Imaino.

They deal with the advantages of including reflective layers and spaced layers in and on certain sides of the intermediate layer. Although Imaino does teach the useful ness of cement spacer layers even in the critical intermediate layer between information layers, it does not suggest the combination of reflective layers and Challener only uses its reflective layer behind the full thickness of both its information layers.

Claims 123-127 are therefore also believed to be unobvious from the cited reference or reference combination.

Group T - Claims 121 and 122

These claims are rejected as obvious from Challener in view of Sproul.

Sproul teaches ZrN, HfN or TiN as suitable hard layers of metal cutting tools, a very different flied of product from the much more delicate information carrier art.

No optical properties are discussed or contemplated by Sproul and the combination of Challener with Sproul would not render these claims obvious to the person of ordinary skill in the art of making information carriers.

Group U - Claims 128 to 130

Claims 128 and 129 are rejected as obvious from Challener with Kugler and Claim 130 is rejected as obvious from Challener alone.

These claims further limit Claim 107 by identifying particularly useful materials for doping the intermediate layer or composing the intermediate layer.

While suggesting phosphorous as a doping material Kugler does not mention boron and Challener teaches neither. The teaching of Kugler also does not contemplate the rigors of an intermediate layer between two information layers so that these claims are also believed to be patentable over Challener alone or in combination with Kugler.

Group V - Claims 132 to 147

This large group of claims that are rejected as obvious from Challener alone or in combination with Tawara, define several specific formulations for the intermediate layer that the inventor has found to be particularly efficient for placement between radiation readable information layers.

None of the detailed parameters for composing suitable combinations of silicone, carbon, nitrogen and hydrogen in the matrix of the intermediate layer and as defined in these claims is found in either Challener or Tawara and their combination is likewise insufficient to render any of these claims obvious.

Group W - Claims 148 and 149

These claims highlight to advantage of the invention in providing increased storage capacity by doubling or tripling the capacity. Both rejected as obvious from Challener, Challener actually teaches only two information layers not three and makes no comment on the storage capacity in GBytes (giga bytes) for a standard 120 cm disk.

There is therefore no basis for holding these claims obvious from Challener.

D.   Conclusions

It is believed that from the foregoing, the following conclusions can be drawn:

1.   That the prior art as a whole teaches that the making of an intermediate layer between two information carrying layers that are read by radiation that must pass through

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at least one of the information layers, is difficult;

2.   That varying the parameters of a reactive vacuum deposition process many make the optical characteristics of the deposition layers unacceptable in an unexpected way;

3.   That those skilled in this art are provided with an abundance of teachings on how to operate various vacuum processes but must, in the end, experiment to determine which process and what parameters suit the strict requirements of an optically active layer to be deposited, particularly in an intermediate layer of a multi-information layered medium.

Based on these conclusions, the claims on appeal are all believed to be patentable over the prior art and the application and claims are believed to be in condition for allowance. The Board is therefore respectfully requested to reverse the Examiner's final rejection of these claims.

This brief is submitted with the appropriate fees and in triplicate.

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Respectfully Submitted,

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IX   APPENDIX OF CLAIMS

Claim 91.   A method for producing an information carrier comprising at least two solid material interfaces adapted to contain information and whereat the information is stored by local modulation of at least one solid material characteristic, from which characteristic reflection of electromagnetic radiation depends at said interface, further comprising at least one intermediate layer between said two solid material interfaces, said at least one intermediate layer transmitting said radiation, said information being readable from at least one of said solid material interfaces by means of radiation of predetermined wavelength, the method comprising the step of:

depositing in said intermediate layer at least one layer at least predominantly comprising Si_vN_w by means of a reactive vacuum coating process, comprising the step of freeing Si from a solid body into a process atmosphere with a reactive gas containing N.

Claim 92.   A method for producing an information carrier comprising at least two solid material interfaces adapted to contain information and whereat the information is stored by local modulation of at least one solid material characteristic, from which characteristic reflection of electro-magnetic radiation depends at said interface, further comprising at least one intermediate layer between said two solid material interfaces, said at least one intermediate layer transmitting said radiation, said information being readable from a least one of said solid material interfaces by means of radiation of predetermined wavelength, the method comprising the step of:

depositing in said intermediate layer at least one layer at least predominantly comprising $Si_vN_wH_u$ by means of a reactive vacuum coating process in a process atmosphere, an optimum of transmission of said layer and of a refractive index of the material of said layer being achieved by adjusting the concentration of a reactive gas in the

process atmosphere, which reactive gas comprises N and H.

Claim 93.   The method according to claim 92, wherein Si is freed into the process atmosphere from a solid body.

Claim 94.   The method according to claim 92, wherein said gas in said process atmosphere at least predominantly consists of two different gases with different ratios of at least one of C content to H content and of N content to H content and wherein said optimum is one of open-loop- and of negative-feedback-controlled by adjusting the ratio of amount of said two gases in said process atmosphere.

Claim 95.   The method according to claim 91 or 92, further comprising applying between a carrier for workpieces, whereon said layer is produced, and an electrode in a vacuum atmosphere a DC-voltage and superimposing to said DC-voltage an AC-voltage.

Claim 96.   The method according to claim 95, wherein said AC-voltage superimposed to said DC-voltage is a pulsating voltage.

Claim 97.   The method according to claim 95, wherein said AC-voltage is generated by intermittently connecting said carrier and said electrode via a first current path and a second current path, which second current path having a considerably lower resistance than said first current path.

Claim 98.   The method according to claim 91 or 92, comprising one of reactive sputtering and of ion plating for said reactive vacuum coating.

Claim 99.   The method according to claim 98, wherein said sputtering is performed by magnetron sputtering.

Claim 100.   The method according to claim 91 or 92, wherein a target of negative or positive doped silicon is one of reactively sputtered, ion plated and reactive magnetron sputtered.

Claim 101.   The method according to claim 91 or 92, wherein the reactive gas is hydronitrogen and is fed to said process atmosphere.

Claim 102.   The method according to claim 91 or 92, wherein the reactive gas is Ammonia.

Claim 103.   The method according to claim 91 or 92, wherein the reactive gas includes Nitrogen.

Claim 104.   The method according to claim 91 or 92, wherein said layer is produced as a layer of an intermediate layer between two solid material interfaces of an information carrier, at which interfaces information is adapted to be applied, and whereat the information is stored by local modulation of at least one solid material characteristic, from which characteristic reflection of electromagnetic radiation depends at said interfaces.

Claim 105.   The method according to claim 91 or 92, wherein said layer is produced at an information carrier as an intermediate layer between two solid material interfaces, which intermediate layer comprises a dielectric layer system with at least one layer, at which interfaces information is adapted to be applied and whereat the information

is stored by local modulation of at least one solid material characteristic, from which characteristic reflection of electromagnetic radiation depends at said interfaces, wherein said layer system has an optical thickness which, at least in a first approximation, is m · $\lambda_o/4$, wherein m is integer and at least unity and is uneven and wherein λ_o designated the wavelength of said radiation which is transmitted through said at least one dielectric layer of said dielectric layer system.

Claim 106.   A method according to claim 91 or 92, wherein the method includes applying a silver layer between one of the solid material interfaces and the intermediate layer.

Claim 107.   A method for producing an information carrier comprising at least two solid material interfaces adapted to contain information and whereat the information is stored by local modulation of at least one solid material characteristic, from which characteristic reflection of electromagnetic radiation depends at said interface, further comprising at least one intermediate layer between said two solid material interfaces, said at least one intermediate layer transmitting said radiation, said information being readable from a least one of said solid material interfaces by means of radiation of predetermined wavelength, the method comprising the step of:

depositing the intermediate layer to have a layer system with at least one dielectric layer and with an optical thickness which, at least in a first approximation, is m.$\lambda_o/4$, wherein m is an integer of at least unity and is uneven and wherein λ_o designates the wavelength of said radiation which is transmitted through said at least one dielectric layer and wherein, depending from said m being an integer, m being reduced by an amount of up to 0.6 or increased by an amount of up to 0.2.

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Claim 108.   A method according to claim 107, including depositing the intermediate layer so that the electromagnetic radiation for either applying or reading information has a wavelength within the band of 400nm $\leq \lambda_s \leq$ 800nm.

Claim 109.   A method according to claim 107, wherein at least one of the solid material interfaces is made to have a reflection of from about 20% to about 40% for a selected wavelength of said radiation.

Claim 110.   A method according to claim 107, wherein said intermediate layer is deposited to have an index of refraction of greater than or equal to 2.59 and less than or equal to 4.6 and an extinction coefficient of less than or equal to 3.0.

Claim 111.   A method according to claim 107, wherein the dielectric layer at least predominantly consists of at least one of silicon carbide Si_xC_y and of silicon nitride Si_vN_w.

Claim 112.   A method according to claim 107, wherein the locally modulated characteristic is the thickness of a solid material body defining at least one of said solid material interfaces.

Claim 113.   A method according to claim 107, wherein said reflection is valid for a first wavelength at a first of said solid material interfaces and for a second wavelength at the second solid material interface, reflection of radiation of said second wavelength at said first solid material interface being significantly lower than of radiation of said first wavelength.

Claim 114.   A method according to claim 113, wherein said first wavelength being

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approximately 635 nm or approximately 650 nm.

Claim 115.   A method according to claim 113, wherein said intermediate layer comprises at least one dielectric layer having an optical thickness which is an at least approximately uneven multiple of a quarter of one of said first and second wavelengths and is at least approximately an even multiple of a quarter of the other of said first and second wavelengths.

Claim 116.   A method according to claim 113, wherein said second wavelength is approximately 785 nm.

Claim 117.   A method according to claim 113, wherein said reflection of said radiation at said second wavelength and at said first solid material interface is 10% at most.

Claim 118.   A method according to claim 107, wherein at least one is valid:

a) the index of refraction n_1 of said intermediate layer is: $2.59 \le n_1 \le 4.6$,

b) the extinction coefficient k of said intermediate layer is at least one of: $k_{300\ nm} \le 3.0$.

Claim 119.   A method according to claim 107, wherein said intermediate layer comprises a spacer layer.

Claim 120.   A method according to claim 119, wherein said spacer layer consists of at least one of a lacquer and of a glue.

Claim 121.   A method according to claim 107, wherein said dielectric layer consists

at least predominantly of at least one of the materials of the group ZrN, HfN, TiN.

Claim 122.   A method according to claim 121, wherein said dielectric layer at least predominantly consists of ZrN.

Claim 123.   A method according to claim 107, wherein one of said solid material interfaces is formed between said intermediate layer and a plastic material or between said intermediate layer and a spacer layer or between said intermediate layer and a high reflecting cover layer.

Claim 124.   A method according to claim 123, wherein at least one of the following is valid:

said plastic material is one of polycarbonate and of PMMA,

said spacer layer is at least predominantly of at least one of lacquer and glue,

said high reflecting cover layer is at least predominantly of at least one of Al, Au, Ag.

Claim 125.   A method according to claim 124, wherein said high reflecting cover layer consisting at least predominantly of Al.

Claim 126.   A method according to claim 107, wherein one of said solid material interfaces is formed at a lacquer surface.

Claim 127.   A method according to claim 126, wherein said lacquer is hardenable by means of ultra-violet radiation.

Claim 128.   A method according to claim 107, wherein said intermediate layer

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comprises at least one semiconductor doping material.

Claim 129.   A method according to claim 128, wherein said doping material is at least one of Boron and Phosphor.

Claim 130.   A method according to claim 107, wherein said intermediate layer comprises C and forms at least one of said solid material interfaces with a further material which contains C as well.

Claim 131.   A method according to claim 107, wherein radiation in the blue spectral range of $400 \leq \lambda_s \leq 500$ nm performs at least one of reading and writing of said information.

Claim 132.   A method according to claim 107, wherein said intermediate layer comprises at least one of Si_xC_y and of $Si_xC_yH_z$, wherein $x \geq y$.

Claim 133.   A method according to claim 107, wherein said intermediate layer comprises at least one of Si_vN_w and $Si_vN_wH_u$, wherein $v \geq w$.

Claim 134.   A method according to claim 107, wherein said intermediate layer comprises at least one of Si_xC_y and $Si_xC_yH_z$ and wherein $x \geq 1.2y$.

Claim 135.   A method according to claim 107, wherein said intermediate layer comprises at least one of Si_vN_w and of $Si_vN_wH_u$ and wherein $v \geq 1.2w$.

Claim 136.   A method according to claim 107, wherein said intermediate layer comprises SixCyHz and wherein there is valid: $x \leq 0.8$, $y \geq 0.05$ and $z \geq 0.1$.

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Claim 137.   A method according to claim 107, wherein said intermediate layer comprises at least one of $Si_vN_wH_u$ and Si_vN_w and wherein there is valid: $v \le 0.8$ and $w \ge 0.05$.

Claim 138.   A method according to claim 107, wherein said intermediate layer comprises at least one of Si_xC_y and $Si_xC_yH_z$ and wherein there is valid: $\{0.445{:}0.262\} \le \{x{:}y\} \le \{0.775{:}0.078\}$.

Claim 139.   A method according to claim 107, wherein said intermediate layer comprises at least one of Si_xC_y and $Si_xC_yH_z$ and wherein there is valid: $\{0.445{:}0.249\} \le \{x{:}z\} \le \{0.775{:}0.118\}$.

Claim 140.   A method according to claim 107, wherein said intermediate layer comprises at least one of Si_xC_y and $Si_xC_yH_z$ and wherein there is valid: $\{0.078{:}0.249\} \le \{y{:}z\} \le \{0.262{:}0.118\}$.

Claim 141.   A method according to claim 107, wherein said intermediate layer at least predominantly consists of $Si_xC_yH_z$ and wherein there is valid: x:y:z=0.704 (±10%):0.087 (±10%):0.131 (±10%), wherein ±10% indicates the statistic dispersion of multiple measurements of the values.

Claim 142.   A method according to claim 107, wherein said intermediate layer at least predominantly consists of SixCyHz and wherein there is valid: x:y:z=0.494 (±10%):0.238 (±10%):0.226 (±10%), wherein ±10% indicates the statistic dispersion of multiple measurements of said values.

Claim 143. A method according to claim 107, wherein said intermediate layer comprises at least one of Si_vN_w and $Si_vN_wH_u$ and wherein there is valid: $\{0.527:0.401\} \le \{v:w\} \le \{0.858:0.099\}$.

Claim 144. A method according to claim 107, wherein said intermediate layer comprises at least one of SivNw and $Si_vN_wH_u$ and wherein there is valid: $\{0.527:0.044\} \le \{v:u\} \le \{0.858:0.009\}$.

Claim 145. A method according to claim 107, wherein said intermediate layer comprises at least one of Si_vN_w and $Si_vN_wH_u$ and wherein there is valid: $\{0.099:0.044\} \le \{v:u\} \le \{0.401:0.009\}$.

Claim 146. A method according to claim 107, wherein said intermediate layer comprises at least one of Si_vN_w and $Si_vN_wH_u$ and wherein there is valid: $v:w=0.78$ $(\pm10\%):0.11$ $(\pm10\%)$, wherein $\pm10\%$ indicates statistic dispersion of multiple measurements.

Claim 147. A method according to claim 107, wherein said intermediate layer comprises at least one of SivNw and $Si_vN_wH_u$ and wherein there is valid: $v:w=0.586$ $(\pm10\%):0.364$ $(\pm10\%)$, wherein $\pm10\%$ indicates statistic dispersion of multiple measurements.

Claim 148. A method according to claim 107, wherein at least three of said solid material interfaces are provided on one side of a carrier substrate.

Claim 149. A method according to claim 107, wherein an information storage

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capacity per side of the carrier substrate is at least 11 GByte at a diameter of a circular carrier of 120 mm.